The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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Tanks and Containers

NO one will deny the importance of tanks and containers in industry. Often, as in gasholders in the gas industry or in oil tanks in the oil industry, the capital value of storage vessels becomes considerable; in these circumstances a great deal of thought is devoted to the design of the vessels and much care is usefully expended on their maintenance. Further complication is introduced in gasholders by the necessity for movement, and much ingenuity has been expended over a century and a quarter in devising structures that can make the necessary movements without being subject to breakdowns or to undue wear. Even to-day the problem is not regarded as solved; fifty years is a normal life for a gasholder, but the Institution of Gas Engineers before the war had arranged with the National Physical Laboratory to conduct an investigation into the subject of gasholder design.

The stability and functioning of the container is not the only problem. Even when a storage vessel is properly maintained and operates with good mechanical efficiency it may yet be an item of expense on an altogether impossible scale. A tank, container, or storage vessel is designed to contain a product—generally a fluid—and to maintain it in a proper state of purity. Losses due to leakage or evaporation can quickly surpass the capital value of the vessel; this rate of loss is exceptional, but that it can occur from a storage vessel that is apparently working normally is evidence of the care that must be taken with the maintenance and inspection of storage vessels. It is also an indication that it may pay to replace a storage vessel with a new one at an earlier date than is often thought necessary.

A similar but less avoidable loss than leakage is that due to evaporation, a problem that occurs wherever volatile liquids are used or produced. Every time the level of liquid in the tank is lowered, gas or air enters to take the place of the liquid removed. This becomes saturated with the vapour at the prevailing temperature and on expulsion, when the tank is refilled, carries with it a percentage of the volatile product. There are various methods of avoiding or minimising this loss. In the coke-oven industry, for example, benzol storage tanks may be gas-filled and connected by pipes to the gas mains before the benzol scrubbers. With many substances it would be possible to place a small active carbon or silica gel absorber in such a position that the air entering and leaving the tank must always pass through it. The oil industry has a difficult form of this problem to meet in the evaporation of petrol and similar low-boiling fractions in hot countries. Oil tanks must of necessity be subjected to the sun temperature as their size generally renders shade impossible, and it can well be imagined that when metal becomes too hot to touch, evaporation of petrol assumes serious proportions. The only remedy generally used is to instal "floating roofs." These are sheet-metal boats which float on, and completely cover, the surface of the oil and thus move up and down with the oil. The design of these roofs is a peculiarly difficult problem, both to ensure stability and to make a reasonably tight joint between roof and tank side. Only one type of floating roof has as yet been generally accepted by the oil industry.

The problems of storage are the subject of few technical communications and but little is to be found in recent literature on the subject of tank design and construction. This issue of THE CHEMICAL AGE is primarily devoted to the storage of liquids and some of the problems that arise are discussed. In the chemical industry the maintenance side of the problem assumes added importance—maintenance against internal corrosion of the metal from which the vessel is made and maintenance against contamination of the liquid stored. The problems that then arise demand special methods, and usually special materials, for their solution. Thus glass-lined tanks, lead-lined tanks, rubber linings, plastics, stoneware and many special metals or alloys are employed. Frequently, moreover, a tank is used periodically for holding more than one substance in turn. Careful cleansing is then necessary and this in its turn raises all the issues of safety, including purging. A volatile, often dangerous or inflammable, vapour may be left behind when the liquid has been run from the tank. The utmost care must be taken to ensure that no ledges or pockets are left in the tank where liquid can remain; otherwise even when the tank has been purged the vapour in the atmosphere can be renewed. The method of purging tanks has usually been to blow air through them, and when the vapour is inflammable a certain element of risk is thereby entailed. Of recent years a machine has been put on the market—and can be hired—for purging tanks and gasholders with inert gas, and this has made a notable addition to general works safety. There have been many tank explosions, or explosions due to the escape from tanks of explosive air-vapour mixtures. Where combustible liquids are regularly handled the provision of an inert-gas machine with arrangements for keeping an inert atmosphere within every tank in use is no bad policy.

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NOTES AND COMMENTS

Conservation of Containers

LOOKING back on the previous occasions when this journal has dealt especially with the subject of containers—an important but rather Cinderella-like subject in the chemical industry—we were struck by the fact that the last number devoted to containers was also the last peace-time issue of 1939. Incidentally, this same issue contained some disparaging remarks about the Russo-German Pact, which throw an interesting light on current events. But, to return to containers, one feature of the subject was at that time comparatively little stressed, whereas readers of the present issue will find it recurring again and again; and that is, conservation of the material of which the containers are built. Corrosion-resistance, both external and internal, is a vital question of the day in the field of metal tanks, drums, and the like; and the cleansing of tanks becomes doubly important, especially when the necessity arises of using them for the storage of unusual or different products. The matter of records, too, assumes an even larger importance in these times than it should normally be accorded. Returnable drums, for example, must on no account be lost trace of even temporarily, for the metal container has a vital part to play in the national war-economy. On final examination the solution is seen to be a simple one, namely, co-operation in the industry, whether inside the works, where the duty of maintenance is ever more essential, or outside, between producer and consumer, where mutual consideration will go far towards furthering the conservation of valuable material.

Women in Trade

PROBLEMS of trade and commerce are to be a special study of both business and professional women in 40 towns of England and Scotland. They are members of the rapidly growing clubs combined in the National Federation of Business and Professional Women's Clubs, which is affiliated to similar federations overseas and has specially lively contacts with women in Canada and the United States. At the June board meeting of the federation held in Sheffield and attended by 170 representatives of clubs from London to Aberdeen, Miss Marjorie Hayward (of Imperial Chemical Industries, Ltd.), President of the Regency Business and Professional Women's Club of London, became chairman of a Committee of Trade and Commerce with a correspondent in each club. She read a message from the President of the Board of Trade, emphasising the added responsibilities of women in trade no less than in the factory or in the Services. Membership is open to all women in business and the professions and already includes women in every sphere of trade and commerce.

Indian Chemical Industry

COMPARED with the American and European chemical industries the extent of those of India in proportion to its population may seem to verge on the unimportant. Nevertheless the heavy chemical industry in India begins to assume imposing proportions. A fair measure of a country's industrial progress can be determined by its use of sodium compounds, says Mr. K. H. Vakil, M.Sc., in the recently published Eastern Group Number of *Indian Finance*. In that case we get an encouraging picture, for during 1938-39 the imports of soda compounds were 2,086,034 cwt., or almost double the 1923-24 imports. Caustic soda imports were about 450,000 cwt. With regard to the production of alkalis derived from salt, two large works were recently put into production and should make India nearly self-sufficient. As it is, the country can supply all the raw materials required for acids except native sulphur, of which the imports are about 25,000 tons per annum; the Industrial Committee of the Bihar Government estimated the future demand would exceed 100,000 tons. So far there are approximately 20 large sulphuric acid works and more could doubtless be accommodated if plant for dealing with native pyrites were constructed. Another heavy chemical increasingly in demand is ammonium sulphate; the imports of this during 1938-39 were 1,534,000 cwt. This is additional to the native output which in June, 1940, had reached 2399 tons. Little progress, however, can be reported in certain other directions. Five projects for the production of sodium and potassium bichromates were recently floated and began competing with each other, yet here the imports are not sufficiently big to justify such a procedure. Again, large coke-ovens are in existence, but the extensive recovery of benzene, toluol, and other distillation products has not been attempted. Still of the position as a whole, it may be said that the Indian chemical industry has good prospects; but it will need to be guided assiduously and limited to markets where the home demands are heavy.

A Good Word for Profit

THE latest of the valuable sixpenny pamphlets on Post-War Questions published by the Individualist Bookshop is a masterly analysis of "The Profit Motive" by Sir Ernest Benn. He finds, to his astonishment and dismay, that the political fashion at the moment is to deprecate profit. The word in fact has come to have a nasty, sinister, undesirable meaning. Yet "profit" is not used in the Bible except in the sense of something altogether worthy and to be striven after. Sir Ernest Benn proceeds to prove conclusively that the so-called profit system is indispensable to all-round progress and prosperity. He is amazed that in all the abuse of profit there is a universal absence of any mention of loss. Yet every person engaged in business or trade knows that profit and loss are inseparable. The trouble with politicians is that there is no Profit and Loss Account in the public ledgers. Council houses, nationalised railways, state shipping and the like have always produced loss, but operations in the freer market outside politics produce either profit or loss and society is kept together by the fact that, with the need for profit and the risk of bankruptcy through loss always in mind, the balance has resulted on the whole in profit. Even that, as so far ascertained, is a small one, 2 or 3 per cent. on all the capital employed. Sir Ernest Benn's summing up of the position gives a clue to the penetrative insight, reinforced by simplicity of statement, with which he approaches economic question: "The abolition of profit will bring about a universal state of loss. In the process, it will first of all abolish all economy, efficiency, and expedition; it will place the consumer in slavery; it will stop up the source of new capital and dispel all hope of progress. The very best that can happen, if the anti-profit policy is pursued, is that we shall go on sharing the profits of the past until, they being exhausted, there is nothing more to share."

STORAGE TANKS

Some Important General Considerations

From a Special Correspondent

STORAGE must be provided on chemical works for a variety of solids, liquids, and gases. Storage vessels may be no more important than an overhead water tank or a concrete dump for waste materials; or they may be required to contain products of a high state of purity and possibly corrosive to ordinary materials. The design of these vessels is often neglected, as storage equipment does not directly produce profits but generally acts as a charge upon the business; moreover, the function of storage vessels too often appears to be of small importance compared with that of vessels in which chemical reactions or manufacturing processes take place.

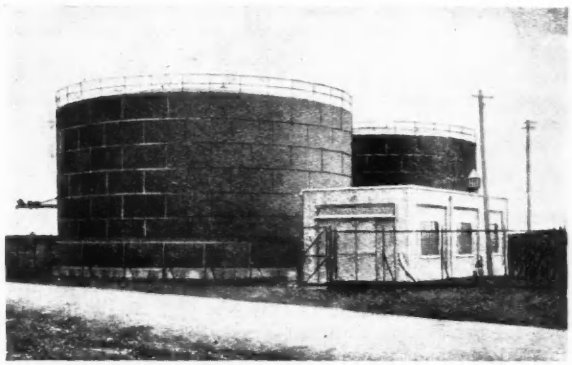
In practice, however, the design of storage vessels provides many interesting and important problems for the practical engineer. The circumstances in which materials are to be stored may differ considerably according to the type of material and the nature of the process in connection with which they are used. It may be necessary to store some materials under pressure; to prevent evaporation; or to prevent contamination; it may be required to clean vessels thoroughly at frequent intervals so that they can be used for storing more than one product. Some vessels may be buried below ground, others may be at ground level, and others again may have to be elevated. The form and proportions of each tank should be designed in accordance with established rules of mensuration so far as this is possible. Local circumstances, however, may necessitate a departure from these rules. The stability, strength, and stiffness of the structure as a whole, and of each part and connection individually, must comply with the laws of mechanics. In all this there must also be a practical factor of safety, partly because of the possibility of unexpected stresses occurring, but also to guard against the effects of corrosion. It may appear quite sound to spend the minimum amount of money on the purchase of a second-hand tank or even on a new tank which has a plate thickness only just sufficient to resist the pressure that will be put upon it; it is inevitable that under practical conditions atmospheric corrosion or the action of the substances contained in the tank will further reduce this thickness and the result may be a disastrous accident or at the least the compulsory purchase of a new tank years before it should have been necessary.

The design of a tank must also include the arrangement of its component parts, its valves, man-hole covers, inlet and outlet pipes, and so forth. These must be so arranged as to facilitate manufacture and to ensure the greatest economy in price by adaptability to simple and satisfactory methods of manufacture. When a tank-maker is given a free hand he can design a tank in accordance with all the principles here laid down, and in such a way that its cost will be the minimum. Yet it frequently happens that the lay-out of the chemical works is in the hands of someone who does not understand tank design, or it may be that there are pre-existing obstacles which so constrict the position in which the tank is to be placed as to render a good design difficult. This initial handicap, however, may be limited by a clear understanding of the principles involved.

Supporting Structures

It is usually necessary to incorporate some form of supporting construction in a tank design. Where there is a battery of horizontal boiler-shaped cylindrical storage tanks this may be no more than a concrete pit with suitable concrete cradles on which the tank rests. An overhead tank, however, may require a supporting construction of considerable strength and for certain shapes of tank this may be of some complexity. The principle involved is that a tank should never be placed high up if it can be placed on the ground; that the supporting structure should be as simple as possible, preferably making use of existing buildings to avoid accidents due to unnoticed corrosion of the metal supports.

A most important principle also is that in assessing the cost of a tank, the cost of supporting it must be included. It often happens that the purchase of a second-hand tank becomes unwarrantably expensive because the shape of the tank may involve extravagances in the methods of support. Instances are not unknown in which dangerous expedients have been adopted to decrease the outlay for the whole structure when this mistake has been made. The space occupied by a tank also may be important and in assessing the total cost of storage some allowance must be made for the value of this space. For this reason it may be cheaper to adopt one form of storage in preference to another simply on account of the available ground space.



Two riveted oil tanks, 59½ ft. in diameter and 29½ ft. deep, part of an installation of eight recently erected by Ashmore, Benson, Pease & Co., Ltd.

According to one authority a storage tank differs from most other types of structure in five ways:

(1) The load and resulting stress are uniform in direction and cannot change rapidly.

(2) Owing to its shape there is a low degree of stress concentrated at critical points.

(3) Before use it is possible to test a tank at its actual working stresses and usually at stresses in excess of the normal working stresses.

(4) The shape and location of tanks generally permit thorough inspection of the shell at any time, even during use, and paint or other protection can be applied readily to surfaces subjected to atmospheric corrosion.

(5) Joints must be tight to prevent leakage of liquid and frequently tanks must be roofed to assist in preventing evaporation losses or to prevent contamination by rainwater.

Much could be written by the practical tank-maker on the method of construction, but this is standard engineering workshop practice and would be out of place in a journal devoted to the chemical industries. It is sufficient to state that the British tank-makers have wide experience in the best methods of construction and are able to employ those best suited to any particular set of circumstances.

Tanks may be welded or riveted. Formerly tanks were always riveted and it must be confessed that there was difficulty in getting a tight tank, particularly for holding liquids of low viscosity, unless the tank-maker really knew his job. There have been many examples of cheap tanks which failed to retain the materials they were supposed to hold. Once a tank is erected in faulty condition it becomes difficult to make it permanently tight. A good tank-maker, however, will have no difficulty in this respect and his work is fully trustworthy.

With a welded tank the difficulty of tightness does not arise, but there is uncertainty as to its strength. Welding enthusiasts will disagree with this statement, but it cannot be denied that the welding of tank plates together *in situ* is an operation depending greatly on the personal element and on the skill of the welder. It is impossible to test the welding when once the tank has been erected, since X-ray tests are not applicable and, unless the tank is to serve as a pressure vessel, it cannot be tested to a higher pressure than that for which it is to be used. Instances have been known of the collapse of welded tanks, but these are probably more often due to the demands of the purchaser for a cheap construction than to any lack of skill on the part of the tank-maker. A tank should be welded inside and out unless it is only a small one holding an unimportant liquid such as water. To-day more and more tanks are being welded, particularly for storage in the oil industries, but most large tanks are still made of riveted construction. Calculation shows that a really sound welded tank joint is stronger than a riveted joint; the purchaser must decide whether he will accept the calculation and purchase a welded tank or whether he will prefer the known strength of a riveted tank to the uncertainties of the welded construction. So far as price is concerned there is very little to choose. Most important tank-makers can construct their tanks either in welded or riveted work so that the tank-maker himself has no axe to grind. Many makers, however, feel that the trend towards welded construction is too rapid and that often quicker delivery and better results can be obtained by retaining the older form of riveted construction.

It was formerly the custom to manufacture cast iron tanks for holding liquids and the cast iron method of construction is often to be seen in old gasholder tanks or ammonia liquor tanks situated above ground. Cast iron is a material with uncertainties, particularly when subject to bending actions, and it has also a certain weakness in its resistance to sudden shocks. Its advantage lies in its resistance to corrosion and its cheapness. As a constructional material for tanks it has now been supplanted by mild steel, or by other special metals when internal corrosion is to be feared. The steel plates used are suitably stiffened and stayed to resist the internal pressure.

Best Materials Must be Used

It should be axiomatic that only the best materials be used for the construction of tanks. With material of uniform and sound quality, the necessary provisions for strength and stiffness and allowance for corrosion and other deleterious influences may be made to known margins. It will often be found, moreover, that the thickness of inferior materials is not uniform; it is also found that the strength of such materials is affected more by differences in thickness than is the strength of good materials. Inferior material, moreover, is more difficult to work; consequently the joints and seams are not so good.

It is always possible to make a cheap tank temporarily sound by red lead and other jointing devices, but it is not long before leaks break through again and once the trouble recommences it soon spreads. A leaky tank is a standing witness either to bad workmanship or to bad material. No jointing material should be permitted in tank seams. All the necessary tightness against leakage in riveted tanks should be obtained by caulking. The strength and tightness of a joint is, of course, the most important feature and here economy must be sacrificed, if necessary, to obtain tightness.

It is believed that the largest wooden storage tanks in the world are those comprising a battery of three erected in Canada in 1935 for the storage and blending of ground wood. These tanks were cylindrical and vertical, 34 ft. in diameter by 56 ft. high, and in their construction 78 tons of steel bands were used.

For certain purposes stainless steel is used in tank construction and these tanks are frequently welded. Formerly there was a difficulty in welding stainless steel tanks because of the well-known phenomena of "weld decay." This was the effect of heat on the structure of the steel which caused its corrosion-resisting properties to disappear in the vicinity of the weld. To overcome this defect it is necessary to resort to heat treatment, but unless the tank was a small one it is evident that this procedure was frequently impossible. To-day advances in the technique of stainless steel manufacture and working have overcome this difficulty so that satisfactory welded stainless steel tanks can be supplied.

The shape of tanks is a subject on which there are very diverse views. Often the shape depends upon nothing more than the particular second-hand tank that can be purchased; often again it is governed by the space available for containing a given volume of liquid. Wherever possible, adequate space should be allowed in order that the tank-maker can design the most economical shape to suit the local circumstances. The cost of a tank, as has been pointed out previously, must be correlated with the cost of its supporting structure and since the shape of the tank often governs the cost of the supporting structure it is clear that the shape of the tank often governs the overall cost.

Many designers, not specially experienced in tank design, would maintain that the most economical shape for a tank is that giving the maximum volume per unit area of containing shell. This conclusion, while sound in theory, and not to be ignored, often neglects the very important fact that the cost of a tank is not always directly proportional to the area of its plating. The cost may be increased by greater thickness of plate necessitated by considerations of size or shape, or by greater stiffening due to increased pressures. Different classes of work, moreover, entail different costs in their workshop construction. As a simple case the problem may be whether to construct a rectangular tank or a cylindrical tank. An authority has answered this problem in these words: "In comparing the suitability and efficiency for tank work of flat plates with those of plates bent to some curved shape, it should be noted that a flat plate must act as a beam, and hence that only the equivalent of half its cross-section area (one-quarter in. tension and one-quarter in. compression) can be fully stressed without exceeding the maximum permissible strength at the extreme fibre, whereas a curved plate, if bent to the proper shape, may have its whole cross-sectional area fully stressed in tension. Hence, although the cost of bending plates is additional, the total cost may be reduced through the bent shape rendering permissible a less thickness of material than would be necessary with a flat plate."

Spherical Tanks

Spherical shapes are more difficult and costly to roll than cylindrical shapes, and although a spherical tank gives the greatest possible content for the least area of shell, it has the three disadvantages that it is costly in workmanship, is more difficult and costly to support, and is closed and therefore not so handy in use unless required for storage of liquids or gases under pressure. Elevated cylindrical tanks may be constructed with a dished bottom, thus increasing their volume to some extent and saving the costly flat plate bottom with its supporting beams and joists.

The primary purpose of this article has been to suggest that tank construction is a highly specialised undertaking, even though it appears on the surface to be remarkably simple. There are a number of British tank-makers who are able to make anything from a small storage tank up to one holding 15,000 or more tons of liquid. With the rise of the oil industry tank construction became very much more important and British tank-makers have become specialists in the art of tank construction in all parts of the world since they began to construct oil storage tanks. This experience is at the command of the chemical industry. It is here suggested that if a strong and cheap design of tank is required the designer of chemical works should allocate as large a ground space as possible to the storage, should state his requirements as to elevation, pressure, and so forth, and then should leave the design of the tank and of its supporting structure to the tank-maker or to be decided in close collaboration with him. In this way the cheapest and most satisfactory construction will be ensured.

Unit Containers for Transport

Requirements Dictate the Choice

by C. H. BUTCHER

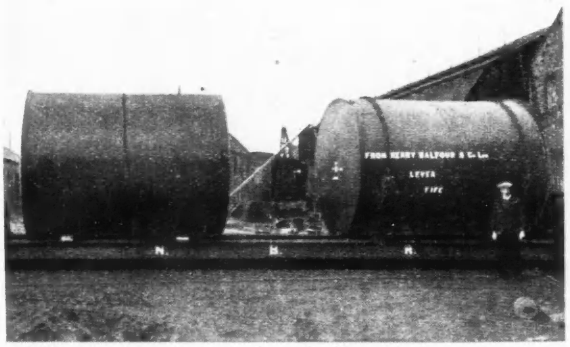
PROVIDING a container that will meet all needs in the matter of transport and storage for chemical products is difficult enough in view of the many variations of physical conditions and chemical actions. There are, however, yet other considerations to be taken into account. Individually, the manufacturer or supplier of the product, and the customer or user, have their own particular needs, but the ultimate choice is affected also by the opinions of the various persons who have an interest or responsibility in the matter of transport. There are the railway company servants and agents; the shippers in cases of export (including those who do the stowing on board); road transport contractors and their servants; and insurance companies who carry the risk of paying compensation where there is loss or damage in transit, or who have to cover third party risks in cases of accident. Added to these there may be the sales agent, who wishes to see a package that will create a good impression on the customer. The particular needs of each are characteristic. The manufacturer of the product may find one particular type of container preferable from the point of view of filling and closing; the customer may want certain good features in the matter of emptying. Servants of the transport concerns, actively engaged in handling the containers, will look for easy handling features and for general safety in that particular task.

Almost without exception as to nature, any manufactured chemical product must be so packed for transport that it never fails to maintain the reputation of the manufacturer or supplier. Where a consignment arrives at the customer's works in damaged condition, or merely suggests easy loss or damage, it may prove difficult to maintain the existing sales record, for a bad impression once created is difficult to destroy. A container must therefore arrive undamaged at the customer's works, its condition generally appreciated as regards appearance and cleanliness—external as well as internal so far as the former is possible. Moreover, a container used for transport must also serve the purpopse of good storage conditions, and it must be easy to handle and to store, and easy to open for emptying. Cost, passed on as a separate item or otherwise covered in the total cost of production for the product, must be low enough to justify acceptance, and special attention must be given to cost in the case of returnable containers which are expected to serve a certain pre-estimated number of journeys.

Guard Against Corrosion

Only in the light of long experience is it possible to say, for any particular product, that a certain type of container is all that could be desired. As regards the characteristics of the product there are both physical and chemical properties to be considered; effects of the atmosphere to which the product may become exposed, liability of the product to expand in hot weather or to be subject to losses by evaporation, and its liability to freeze or solidify during cold weather. Liquid or solid conditions (the latter including loose crystals, granular forms and powder, as well as products which melt and solidify to a compact mass) restrict the ultimate choice: liquids, for example, demand the use of either metal drums, tight wooden barrels, metal cans, glass carboys, or glass or stoneware bottles. The corrosive nature of the product may call for use of a particular material. When a steel drum appears to be preferable on certain considerations, it may be known that the liquid attacks steel to greater or less extent according to the concentration of the liquid and the quality of the steel, and this may require the provision of a special lining or an internal surface treatment which is not affected. For instance, it may be necessary to use drums which are completely galvanised within and without, or coated internally with lead or tin. This same feature of corrosion may have to be considered for lump, crystal or powder forms with the employment of wooden kegs or barrels.

For most dry powders, and also for some crystal and semi-crystalline solids, the possible ill effect of absorption of moisture has to be considered seriously. In the case of liquids the problem does not arise, as the closure adopted would normally be tight enough to avoid this if the container is to be liquid-tight. Distinct from absorption of moisture, there may be loss of moisture in the case of certain solids



Mild steel transport tanks, of all-welded construction, built by Henry Balfour & Co., Ltd., Leven, Fife

which have a tendency to effloresce. Other products with water of crystallisation may cake unless packed in rigid containers; for instance, if packed in bags some chemicals cake seriously under the compression resulting when the bags are stacked in a warehouse, and quality may suffer considerably. It is, therefore, wise to seek information on the ultimate use of the product, as this must be taken into account alongside the matter of cost when the latter has to be kept at its lowest. Where liquids freeze during cold weather a container must withstand the resulting stresses; this has to be borne in mind especially as regards the mode of construction of metal drums and cans.

Regulations in the matter of transport are important; the product may be classed as dangerous and may need a particular type of container which has been approved as safe for handling. Added to this, there are the separate transport problems and for export, possibly, certain regulations at the ports of shipment and of entry. It is necessary to become fully acquainted with the conditions which are likely to be met in transport, and also in handling and under storage at the customer's works. Necessary structural strength is dictated by the approximate amount of rough usage the container will receive in service; a container which offers facilities for easy handling will avoid a proportionate amount of rough usage. The need for the package to arrive at the customer's works in a satisfactory state as regards its appearance, as well as the security of its contents, will necessitate a certain minimum strength; the weight of the contents also enters into the question of minimum strength or thickness for the metal or other material used. Rail, road and sea transport all offer different conditions of usage, as does the distance normally travelled, with number of reloadings or re-shipments in the case of indirect transport.

The manufacturer or supplier of the product is concerned with the important item of cost, especially in the case of returnable containers; with the ease of filling under conditions existing at the works and for the nature of the product; with the ease of handling, or adaptation to conveying systems if such are installed; with the ease of storage while awaiting

despatch to meet orders; possibly also with the speed of production by the maker of the container in view of keeping pace with sales, or rush orders or some unforeseen contingency.

Filling problems at the chemical manufacturer's works can usually be adjusted to meet a container which has been selected on account of other advantages in service. Cost has to receive attention for the separate cases of returnable and non-returnable, single journey, containers. It is not correct to assume that an inexpensive product may always be packed in an inexpensive form of container. In many cases it will be found that the physical and chemical characteristics of low price products do not allow the use of a cheap container, and this is especially so when the container is returnable. Cost, moreover, is not to be regarded from the viewpoint of the actual purchase price alone, for there remain to be considered also the questions of ultimate disposal (possibly a matter of scrap value), comparative cost of handling, weight (in so far as it may affect transport charges), and the extent to which the cost can be passed on to the customer, especially for a non-returnable or single-journey container.

Of concern to the customer are ease of handling and ease of storage; general appearance, so far as it reflects the reputation of the supplier; capacity adequate to the orders likely to be forthcoming; and convenience in use. A little extra facility offered to customers in the matter of handling and emptying a container will materially assist an upward movement of sales in the face of competitive sources of supply when qualities are equal. This is especially important when a product is offered for the first time and where other manufacturers will sooner or later compete. It will pay to obtain some information as to conditions at the customer's works, taking particular note of available equipment where the customer is likely to place large orders. Conditions of the atmosphere at the customer's works should also be noted, for this may mean storage under bad conditions and therefore demand special attention to the type of container employed and the means of closing in order to prevent the deterioration of contents. The use of certain exterior finishes becomes a matter of concern when the air is laden with corrosive fumes or is very humid. For this reason it is well to test the resistance of paint against ill-effects from atmospheric corrosion.

Containers for Dangerous Products

If the product is scheduled as dangerous, or is otherwise considered so, it is advisable to draw attention to this fact and to the care to be exercised when opening and emptying; it is also important to emphasise the care desirable in opening returnable containers, which otherwise may suffer damage and so become unfit for further use. Instructions for opening should be prominently stencilled on the package, especially where precautions have been taken to safeguard the contents against deterioration or in such cases as "easy opening" heavy duty paper bags.

The most convenient size of package to adopt is conditioned by the fact that customers may use specified amounts of the product, or that there is an average customers' choice. Methods of emptying may have to be considered in detail, for sometimes the product has to be emptied completely from the container into a storage vessel or otherwise used direct in processing equipment, and at other times used in small amounts direct from the package in which it is received. If special equipment is used for emptying, particularly with liquids or meltable solids, the container must be adaptable for this. Ease of opening and emptying must not be disregarded, no matter how much more troublesome—within reason—the first closing may be by comparison. The cost of handling large containers may be relatively high; on the other hand, a small container may prove very costly as regards the number required to meet trade demands.

The metal drum, once used exclusively for liquids, is now regarded as an equally convenient and safe method of transport for dry powders as well as for stiff and soft pastes. For dry powders it offers the advantage of completely avoiding loss by leakage and deterioration of contents by exposure to the air, by contamination, or by water damage. Capable of being made of metal of different thicknesses, there is a range of strengths to meet all conditions of transport. The light-gauge, non-returnable, single-journey, metal drum provides good storage, for which the cost—borne by the customer—is not prohibitive; such drums can be emptied when needed. To the supplier of the product their use avoids a high initial outlay of capital and the necessity of charging and crediting empty drums.

Heavy-gauge metal drums of the returnable type were first introduced for the transport of dangerous liquids. This type of drum is now made with great attention to detail, and can give almost unlimited life for the most hazardous of journeys. Two shapes are available—the cylindrical shape or straight-sided drum of equal diameter from end to end, and the bilged shape with its maximum diameter half-way from end to end. The bilged or true barrel shape is handier to turn on end when full, and may be rolled about and moved into any desired position easily. In addition, the bilged construction stiffens the body and gives extra resistance against severe blows. For the cylindrical shape the provision of rolling hoops as a feature of construction is necessary to facilitate movement. These rolling hoops are usually made of I-shaped metal, but in the case of non-returnable metal drums there are means for easy rolling in the form of less costly rings, pressed from the body when it is being shaped ready for welding. Some non-returnable drums are corrugated over the greater length of the body to give additional strength when the thickness of the metal has been reduced in order to save cost and weight.

Metal drums with all-welded side and end seams are the least susceptible to leakage; end seams which are caulked must be such that they are unaffected by any liquid for which the drum is used. A returnable drum demands special attention to the strength of the seams, in view of the severe handling to which it may be subject in continuous use. Filling and emptying holes for liquids must be sufficiently strong to avoid distortion when screw plugs are tightened or released; with a removable end on a drum intended to hold a powdered or pasty product, the "full open" head or end is preferable to all other constructions on account of the greater ease and assurance with which the contents can be removed. Applying to all products irrespective of their physical form—liquid, paste or powder—a drum that cannot be completely emptied without difficulty is unsatisfactory to the customer.

The metal can, for liquid products, offers a range of sizes and two distinct shapes; it can be cylindrical with a conical top, or of square cross section with appropriate pyramid-like top, better described as round and square "tapers." The tapered top allows the contents to be removed in quantities as required, or drained to the last drop. The tapered top makes it difficult for such cans to be stacked, and thereby prevents the bursting of seams by the superimposed weight of other cans. The square taper gives advantage over the round taper in providing for greater capacity per unit of floor space occupied, and in offering a better exterior surface for displaying the name of the product and the supplier.

Barrel Construction

Wooden barrels can be slack or tight, according to whether they are to be used for solid or liquid products. Slack barrels have either plain or tongue-and-grove edges to the staves, but it will generally be found that a good quality slack barrel made with plain staves gives good powder-tightness if the requisite number of hoops are properly driven down. Nailed hoops are more secure than those which are punched to hold them in position, but it is essential to be sure that the nails do not project through the staves and so become liable to damage any internal paper liner. Hoops should be of the steel band type, preferably galvanised. The bilge of the barrel should not be too high, for this reduces the strength as a container; the extra capacity obtained by a

high bilge is not justified in view of the loss in strength, and it is better to use a large barrel with the standard bilge. The position of the hoops in relation to the bilge is also important for strength. Heads should be reinforced by wood battens at right angles to the joints and shaped at the ends to conform to the shape of the chime of the barrel. Different methods are offered for securing the heads, for instance, they can be nailed through the chime hoops and staves, or fastened by methods of patented design. Tight barrels must be made with staves that have been thoroughly seasoned and kiln-dried. It is advisable for export purposes to use bung straps to hold the bungs in place.

The common burlap sack or bag must be made of stronger material, including the sewing twine, when it is to be used for export. Added strength can sometimes be obtained from material woven with a larger number of threads in one direction, without increase in weight. Loose liners for such bags should stretch in all directions; for protection against moisture there are liners having a layer of asphalt between two plies of crêpe paper, but the use of rubber latex in place of asphalt may give greater flexibility as there is a tendency for asphalt to stiffen in cold weather and so increase the risk of rupture.

Paper Containers

Multi-wall paper bags are now greatly favoured for packing powders and granular products. Exceptional strength is offered against rough usage in transport, and with the adoption of automatic bag-filling machinery there are advantages to be secured. The paper bag of the "pre-closed" or valve type is made specially for use with automatic bag-filling machinery, but some products are not handled easily on account of their physical character, while possible chemical action may prevent use of a paper bag. The pre-closed bag is closed at both ends except for a small opening or valve at one corner; the bag is filled through this valve, which is so designed that it is self-closing by internal pressure of the contents when the bag is removed from the filling machine. Paper bags are very suitable for export purposes, and can be stacked to great height without suffering rupture.

Fibre drums have three distinct advantages for the packing of dry powders and granular products. They are lighter in weight than metal drums or slack wood barrels; they are impervious to the penetration of moist air, and are not externally affected as to appearance, and therefore acceptable for export uses; their strength can be increased to meet abuse in transport, and they are easily handled.

The Glass Carboy

The glass carboy is still used in quantity for the transport of acids and other corrosive liquids. Efficiency is raised by the method adopted for packing the carboy in its metal or wicker crate; mineral wool is preferable to straw as a packing material, on account of the combustible nature of straw and because the cushioning property of straw is much reduced when it becomes wet. As an alternative to glass carboys, aluminium drums have proved advantageous for carrying nitric acid of certain strengths, while steel drums of certain quality can be used for sulphuric acid. The glass carboy, however, is still used on account of its greater initial cheapness and because it is a robust container in spite of being made of a relatively brittle material.

Drums for Transport in America

Carrying Calcium Carbide by Rail

MANUFACTURERS in the chemical industry in the United States, like their colleagues in this country, have devoted considerable time, effort, and money to the development of containers which are best suited for the proper delivery of their products to consumers. The best containers will fail, however, unless they are properly protected and braced when shipped by rail. The transportation of calcium carbide is a question that concerns American manufacturers much more closely than British, but its individual problems are of considerable general interest. Mr. J. Carl Bode, plant superintendent of the National Carbide Corporation, Keokuk, Iowa, has discussed the matter in *Chemical Industries* (1941, *48*, 3, p. 313).

Although various sized containers are used, he points out, by far the most common is the 100-pound size. Since calcium carbide must be protected from water, whether it be actual water or merely humidity in the air, metal seems to be the logical material for the container. As the container is merely excess baggage and is discarded after the contents are used, it should be as light as possible consistent with other requirements. Preventing such containers from becoming badly bent up brings up the question of proper bracing of the load in the railway truck, for damage to the drum not only destroys its appearance, but also may open seams or puncture the drum.

Before 1926 the Corporation employed wooden bracing for rail shipments. This consisted of the usual method of constructing gates from 2 in. by 6 in. timber, placed against the ends of the loads in the doorway of the truck with 2 in. by 6 in. braces fastened to cleats which were spiked to the sides and floor. This method was unsatisfactory, as the shock of the load against the gates ripped the cleats loose and splintered the braces which then permitted the drums to tumble about.

A slight improvement was obtained by loading in such a manner that only about 18 in. of empty space existed at the doorway and this space was cribbed between the 2 in. by 6 in. gates. While this reduced the damage, results were still far from desirable, as the load was too rigid and trouble with crushed drums was experienced. Occasionally even the cribbing was splintered, thus again permitting the drums to tumble about in the truck.

In 1926 a method of bracing the drums in the car with Acme Steel bands was adopted. This method consisted of two horizontal bands around each tier of drums. Each tier of nested drums was thereby held together as a unit, and the fact that these units were not fastened to the truck gave the load sufficient flexibility to shift or slide under impact, thus preventing the tendency to crush the drums. Damage was very materially reduced, and one man could fasten a truck-load in from half to three-quarters of an hour. Heavier shipments were also made possible. This method served quite well until the railways started to speed up freight movements. This increase of speed resulted in rougher handling, and damages again began to creep upward. It was therefore necessary to develop a method of bracing that offered even better protection.

After considerable experimenting, the method now in use was adopted. It consists of end gates in front of and behind the load, all bound with Acme Steel bands to form a unit. The whole unit is still free to move on impact, but it has cut down the tendency of one tier to move with relation to another.

Occasional damage still occurs and it may never be possible to develop a method of loading that will guarantee 100 per cent. protection. However, great improvements have been made, and it has been found feasible to increase the load per truck from a maximum of 400 drums to 1000 drums. Labour for bracing is much less, bracing material costs are less, and, what is most important, damages are far less.

CHEMICAL STONEWARE VESSELS

Advantages in Storage and Transport

FROM the early experiments of mediæval alchemists to the present large-scale industrial production of chemicals, stoneware has been used for the processing, storing, distribution and transport of corrosive liquids. To-day, not only in the heavy chemical industries, but also in the manufacture of foodstuffs, essences, pharmaceutical products, cosmetics, paper, textiles, dyes, etc., stoneware is finding ever increasing applications.

It is a noteworthy fact that, despite the discovery of new metals, alloys, and synthetic materials, chemical stoneware is

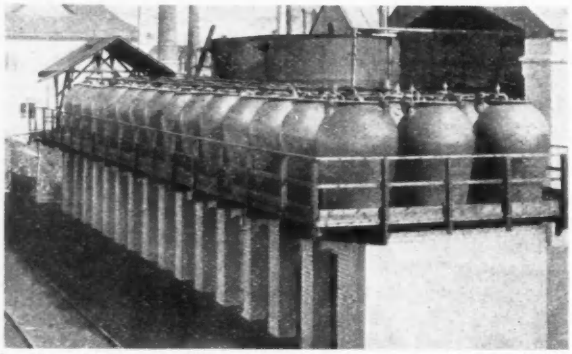


Fig. 1. Battery of 45 stoneware storage vessels installed at a continental works

in greater demand in this country than ever before, while on the Continent and in the United States its use is even more extensive than here. There are two main reasons for this: firstly, no other feasible material has the all-round resistance of stoneware to acids and other corrosive liquids; and secondly, the last few decades have seen remarkable improvements in the physical properties of stoneware, as is clear from the following comparative figures:

		1921	1933
Compression strength:	kg/cm²	5816	8210
Tensile strength:	kg/cm²	116	528
Bending resistance:	kg/cm²	416	953
Elastic modulus:	kg/mm²	4175	4175
Torsional resistance:	kg/cm²	251	323
Impact strength	cmkg/cm²	1.9	4.97
Abrasion test (loss in cm³)		3.0	0.6
Water absorption per cent.		0.5	Nil
Coefficient of expansion		$4.1 \times .10^{-6}$	$0.15 \times .10^{-6}$
Thermal conductivity: kg.cal.m^{-1}, h^{-1}, °C.$^{-1}$		1.35	3.95

(Felix Singer *Chemistry and Indmstry*, November, 23, 1934.

The resistance of chemical stoneware to high temperatures has recently been greatly increased, as well as its thermal conductivity, and while it is not yet possible to heat vessels of this material by means of a naked flame, jacketed pans and agitators are successfully employed.

Chemical stoneware is a highly vitrified, dense, ceramic material which resists the action of all acids and corrosive agencies, with the exception of hydrofluoric acid and hot, strong, caustic alkalis. It differs from other clay products in the number of alternative processes which may be utilised in its manufacture. These include shaping on the wheel, extruding, hand-pressing, dry-pressing, and casting, and their variety makes it possible to produce stoneware vessels and plant of almost any required shape in capacities which may range from under one ounce to several hundred gallons. At the present time it is essential to employ to the greatest possible extent plant made from native raw materials not exclusively required for the production of armaments. Every possible opportunity to utilise stoneware equipment should therefore be carefully investigated. The following brief indications may be helpful to industrial chemists and chemical engineers who have not hitherto envisaged the possible applications of this material for containers for storage and transport.

For the storage of acids and other corrosive liquids in bulk, a battery of stoneware vessels as shown in Fig. 1 is a very suitable installation. As will be seen from the sectional drawing (Fig. 2) each vessel is connected to its neigh-

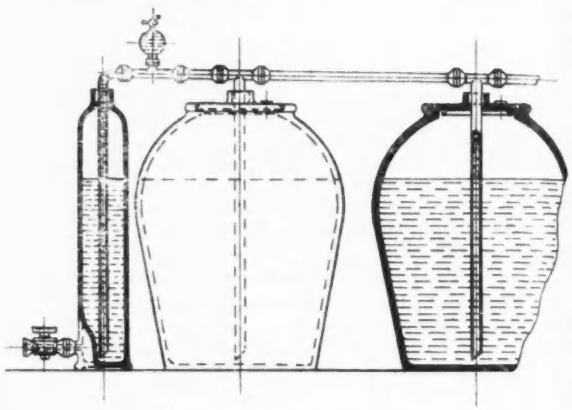


Fig. 2. Sectional drawing, showing method of operating a battery of stoneware storage vessels. (Doulton & Co., Ltd.)

bour by means of a syphon pipe which is continued as far as the narrow delivery vessel. To operate a plant of this kind it is necessary to prime each container with a small quantity of liquid. The pipe line is then exhausted through the glass connection and sight bulb, whereupon the liquid syphons over until the level is the same in all the vessels. Bulk supplies may now be admitted to any vessel in the system and will be equally distributed to all of them by means of the syphonic action. The contents are withdrawn through the cock at the base of the delivery vessel, the narrow shape of the latter causing a rapid fall in level, compared with the liquid in the jars. As a result, the liquid syphons over from the nearest jar and as the level falls in this the same pro-

Fig. 3. Group of stoneware jugs and jars, showing five different types. (Doulton & Co., Ltd).

cess is repeated throughout the system. Such an installation has several advantages. It operates as one single unit, separate bottom outlets for the single vessels are not required, and the quantity of liquid in the battery can be measured by means of a suitable float and indicator. The smooth glazed surfaces are easily kept clean and the risk of accidents is reduced to a minimum. The vessels may be filled by means

of stoneware ejectors, acid eggs, force pumps, or centrifugal pumps, together with the necessary stoneware pipe lines. It is, of course, essential that the joints in the pipe lines connecting these vessels should be air-tight, and standard conical flanged stoneware joints and couplings are used for this purpose.

Owing to its non-absorbent properties, even if unglazed, stoneware is an excellent material for the storage of sterile products, and containers for this purpose or for distribution may be autoclaved or otherwise sterilised without difficulty. Containers for liquids may be sealed by means of corks, screwed stoppers (up to 3½ in. diameter) or ground plugs or covers, the latter held by metal clamps. In some cases a rubber closure is used. Fig. 3 shows a variety of smaller stoneware jars and jugs, the one on the left having a patent air-tight cover. An important war-time application of these containers for domestic use is for storing drinking water and "iron rations" for use in an emergency.

Transport Requirements

For transport by road or rail, containers may be wicker-covered or packed in metal crates in a similar manner to the usual glass carboy. For bulk transport, it is a common practice on the continent to use road or rail trucks, fitted with a number of stoneware jars of about 2000 litres capacity each (Fig. 4) but up to the present this method has not been adopted in England.

For solid or semi-solid products, wide-mouthed containers, with or without stoneware covers, are available. These are particularly suitable for ointments, dry drugs, preserves, food pastes, etc., and are used in many shapes and capacities. For foodstuffs and drugs, where even the least interaction between the product and the container would be deleterious, stoneware is an ideal material because of its chemical inertness. Apart from its other advantages, the smooth glazed surface is easily cleaned and the body is non-absorbent.

Rectangular tanks are made in various capacities from 2 to 300 gallons or more. Large vessels and tanks can be

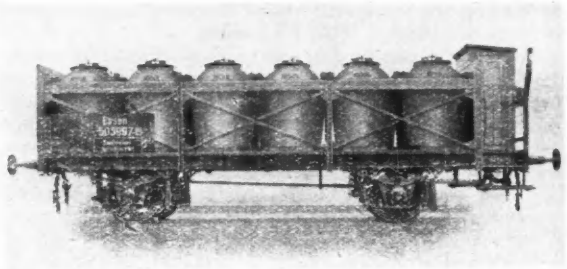


Fig. 4. Continental rail truck, equipped with battery of 1000-litre stoneware transport jars

mounted on special stands or portable chassis to facilitate handling. If very large quantities of liquids or solids are to be stored in one container, it is often convenient to use stoneware tiles for lining brick, concrete, or other vessels. Set in special cement, these are very suitable for dairies and food manufacturers, as well as for silos of all descriptions. Here again, the American and continental European countries make far greater use of stoneware tiles than is yet the practice in this country. The advantages, where either corrosive attack or contamination of products may be expected, are undoubted.

In considering the use of chemical stoneware for storage and transport vessels it should be noted that British chemical stoneware manufacturers are invariably ready to co-operate in designing special plant to meet the different needs of various industries. It is indeed largely by such co-operation between manufacturer and customer that stoneware has reached its present-day importance as an engineering plant material. Another point of special value at the present time is that almost any type of equipment which can be made in metal can be duplicated in stoneware, subject to those modifications called for by the physical characterisics of the latter material.

Bulk Storage of Chemical Liquids

The Virtues of Various Materials

by "CHEMICAL WORKS MANAGER"

MATERIALS of widely different character are now used in the construction of tanks for the storage of chemical liquids in bulk. Apart from different varieties of steel and other metals in sheet form there is wood and concrete, the latter serving mainly as a structural material to be subsequently treated or lined should it be necessary in order to prevent common leakage. "Clad" steels have also been pressed into service, as well as a variety of linings—rubber (hard and soft), asphalt, synthetic resin compositions, and ceramic tile, among others—applied to steel, wood and concrete alike to meet particular needs in countering corrosive action. Storage systems made entirely of acid-proof chemical stoneware take the form of batteries of standard size vessels, inter-connected to serve as one large tank; there is difficulty in making and transporting stoneware vessels of a size exceeding a certain maximum.

Commonly, tanks or storage vessels are either cylindrical (in vertical or horizontal position), rectangular, or spherical; the latter are used for the storage of liquids which are especially volatile and liable to develop serious pressure when the tank is exposed to changes in temperature, other than by intentional heating.

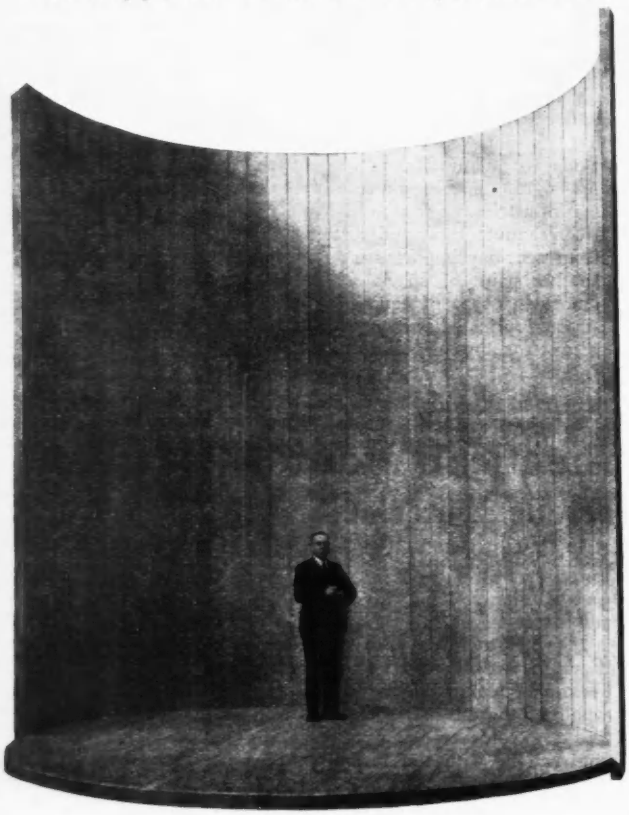
Mild steel plate or sheet is a convenient structural material where the nature of the chemical liquid does not prohibit its use; as alternatives, there are aluminium, copper and other non-ferrous metals in sheet form, with their respective ease of fabrication and each offering their own particular properties as regards resistance to the action of different chemicals and solutions. Lead, in sheet form, has insufficient rigidity for direct structural use and must be employed as a lining if required, as in the case of the storing of sulphuric acid. As a substitute, there is homogeneous lead lining—which is securely fixed to the base metal shell of the tank over the whole of the internal surface as well as the face of flanges, and so avoids creeping and sagging under expansion and contraction, with the formation of blisters, if the tank is heated at intervals.

Metals offering a rigid structure are either welded or riveted. Welded tanks not only present a neater appearance, but by comparison with riveted tanks they are theoretically less liable to leak in service. The general convenience of welding allows a certain flexibility in design as regards shape of the tank and the attachment of the inlet and the outlet pipe or other connections, thus allowing them to be placed in difficult but desired positions without the attendant clumsiness of the flanges. Riveted tanks, properly proportioned and having the necessary number and strength of rivets, offer the greatest general strength, but in most cases the strength requirements of tanks and vessels for storage purposes are not in excess of certain figures depending on the storage capacity in terms of weight of liquid, relative to the shape and proportions of the tank. Sometimes riveted or bolted structures are more desirable when it is necessary to erect a tank without undue disturbance of plant and machinery already in position.

For aluminium, riveting has the advantage of not impair-

ing the properties of a heat-treated aluminium alloy, as would be likely in welding, cold rivets being used as distinct from the riveting technique for steel; aluminium or aluminium alloy rivets must be of exactly the same composition as the sheet metal which is employed, in order to avoid troubles from galvanic action and subsequent corrosion. For copper, welded seams are similar in appearance to those of steel, except that they are broader and, in the case of thick sheets, have also a greater thickness of weld metal; this difference is necessary to provide increased transverse strength and to fit the seams for the subsequent hammering by which they acquire a smooth convex shape.

The so-called "clad" steels consist of mild steel faced on one or both sides with a relatively thin layer of metal offering better corrosion resistance, such as a stainless steel or nickel, and are firmly bonded by a welding process in course of manufacture. They effect a financial saving in the making of tanks where the particular corrosion resisting metal is needed. Special flanging technique is called for in fabricating such a tank, so as to avoid exposure of the base steel at any point in the interior of the tank, but this offers no



Wooden vat, 15 ft. in diameter and 18 ft. deep, of 20,000 gallon capacity, constructed by Robert Airey & Son, Huddersfield

difficulty. Such clad steels are used widely as linings to tanks made of other materials giving the requisite structural strength. The sheets are fitted to the walls of the tank in courses, each sheet being secured to the wall of a metal tank by arc welding, and vertical and horizontal seams are then lap welded.

Concrete makes an ideal material for storage tanks from a structural point of view, when built on a site. Its most serious drawback is disintegration under the action of some chemical liquids, or leakage occasioned by the porous nature of the concrete or shrinkage cracks. Such tanks should be built with reinforcing steel well distributed, so that shrinkage cracks are reduced to mere hair-lines. The best mixture is provided by one part cement to 1½ parts clean sharp sand and 3 parts stone, in equal proportions of crushed limestone and granite. When the concrete has dried out, the whole surface is given a coating of hot asphalt, and bars or other means for supporting an interior metal lining are fixed. Metal linings should be welded electrically to avoid damage to the asphalt coating, but where electrical welding is not possible, a phenol resin coating can be used in place of asphalt. Such concrete tanks are very suitable for lining with lead, as well as with stainless steel, nickel or other metals in thin sheet form.

In a novel application of concrete to tank construction, hollow porous tiles of special design have been embedded in the concrete walls so that they provide a continuous path for the circulation of water. From these tiles the water penetrates the concrete structure wherever that is possible, and also spreads in a thin film over the inner surface of the tank. By this means a storage tank is provided for holding petrol, without leakage; the petrol is unable to penetrate the concrete owing to the latter being pre-saturated with water. Similar methods of pressure balancing have been applied to the trouble of seepage in the use of tile or carbon block linings, where there is porosity of material, development of crevices or cracks due to variations of temperature, or to the use of porous bonding materials or cements. Tanks used for the cooking of alkaline pulp in caustic liquor have used a solution of alum as the saturating medium.

Wood can be used for building storage tanks of very large capacity, such as those approaching two million gallons. The available woods are redwood, cypress and pitch pine, but of these redwood is being used to greater extent. Redwood proves to be very serviceable for storage of solutions of many of the organic acids, especially acetic and tannic acids, even where the solutions are at boiling temperature. Commercial mineral acids, excepting those of strongly oxidising type such as nitric and chromic, can be stored safely in redwood tanks; for concentrated mineral acids, the wood tanks can be lined with rubber or lead according to the nature of the acid. Satisfactory service has been given by wood tanks in the storage of certain organic acids and acid extracts when the wood has been paraffin-impregnated.

Chemistry and Wool

Professor Speakman on Recent Discoveries

DELIVERING the Mather Lecture before the Textile Institute at Manchester on Wednesday last week, Professor J. B. Speakman, who occupies the chair of Textile Industries at Leeds University, spoke of the scientific developments in the wool and wool textile processes. The scientist now had an established place in the wool textile industry, he said, but unfortunately the industrial significance of such developments and their bearing on the general and technical education of future industrialists were as yet appreciated only by the few.

During the past dozen years the structure of wool fibre had been largely elucidated by X-ray and physico-chemical methods, and while twenty years ago, for example, only two reagents were known to be capable of imparting an unshrinkable finish to wool, fundamental research had led to the discovery of many other reagents and processes which could be used for this purpose. Presumably it was because the fundamental research on the structure of wool was carried out mainly in this country that all recent inventions in this field were British.

It had been found possible to devise suitable means for correcting the long-standing difficulty of dyeing uniformly both wool staples which were exposed to light during growth, and wool garments which were unevenly exposed to light during use. New methods of treating wool to make it resistant to acid dyes had been discovered, and these processes should make it unnecessary in future to send wool abroad for treatment designed to reduce or remove its affinity for acid dyes.

There was evidently an urgent need to see that those entering the textile industry should receive a sound scientific training at school as a basis for later scientific training in textile technology.

Welding Construction for Aluminium Tanks

Automatic Carbon Arc Process

AUTOMATIC carbon arc welding is reported to have many advantages in the construction of aluminium tanks. The process permits faster construction and a considerably better quality weld together with marked freedom from distortion. This development was brought about by a desire to improve quality, not to lower costs which are practically unchanged due to the increased flux cost cancelling the labour saving. Since no bevelling of plate edges is required, the full thickness of metal is utilised in the welding by simply butting the square edges together, greatly simplifying the set-up of the work. The welding time per tank is noticeably shorter than

Welding a head in an aluminium tank by the automatic carbon arc process. The tractor-type automatic welder remains stationary while the tank is rotated underneath the arc.

previous methods since the automatic weld is made in two passes instead of three formerly used. The fact that automatic welding permits welds of complete overlapping penetration accounts for the greatly improved quality of the weld.

Freedom from distortion is encouraged by this method because of the faster welding this process makes possible. Very little straightening is required on round tanks thus welded whereas, with the older method, considerable straightening was necessary. This advantage not only simplifies production of the shell itself, but, because the shell is so uniformly round, the heads are readily fitted to the ends of the shell.

Materials used in constructing tank cars of aluminium include: a bottom plate $\frac{3}{4}$ in. thick; two sides, or top, plates $\frac{1}{2}$ in. thick; and two heads $\frac{3}{8}$ in. thick. The tanks are 78 in. outside diameter and 32 ft. overall length. Square-edge tight butt welds are used throughout in construction. The difference in thicknesses of the butting edges is taken care of by maintaining uniform outside diameters and making up the difference by an off-set on the inside of the tank.

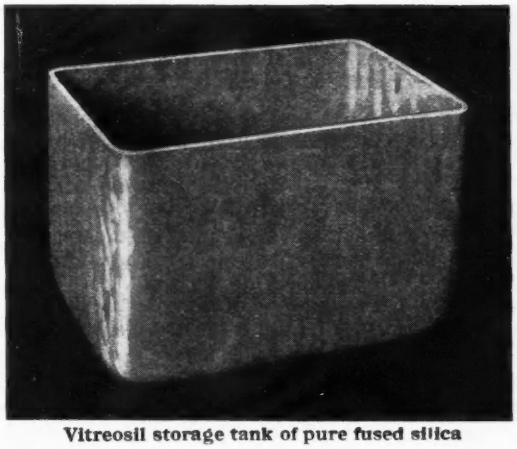
Three longitudinal welds, two consisting of $\frac{1}{2}$ in. to $\frac{5}{8}$ in. and one of $\frac{1}{2}$ in thickness, are required in constructing the shells. Two passes, one inside and one outside, are required for each longitudinal seam. The first longitudinal pass is made on the inside with the seam properly backed up with a water-cooled copper chill bar, giving complete penetration with one pass. The second pass, made on the outside, is applied to obtain overlapping penetration and for the sake of appearance. It is made without any backing up. In welding the heads to the shell, the head is fitted and the tank rotated under the carbon arc which welds the outer seam with the inside properly backed up with copper chill bars. Filler metal for the weld is supplied by $\frac{1}{4}$ in. aluminium wire fed into the arc. The second pass on the head weld is done manually after grooving with a chipping tool.

These tanks, constructed of a 97.5 per cent. aluminium alloy, have, for the most part, been utilised for glacial acetic acid service. Two of the tanks have also been put into service for carrying peroxide, being constructed of a 99.5 per cent. aluminium alloy.

Fused Silica Tanks

Storage of Corrosive Solution

VITREOSIL, pure fused silica, is a very suitable material for tanks which may be required to hold corrosive solutions. The material is unreactive with acids, except hydrofluoric and phosphoric, at all ordinary working temperatures, is highly resistant to many solutions and liquids not acid and withstands sudden temperature changes and prolonged heating. Vessels may also be heated up to 1100° C. For these reasons contamination of a solution, *e.g.*, a plating bath, is



Vitreosil storage tank of pure fused silica

reduced to a minimum, while the heat resistance gives an added factor of safety so desirable in handling such materials as previous metal solutions. Hence Vitreosil vessels are being extensively employed in precious metal refining and the extraction of radium compounds.

The Thermal Syndicate, Ltd., Wallsend, Northumberland, will be pleased to advise on the suitability of Vitreosil for a specified solution and take this opportunity to advise that tanks such as that illustrated can be supplied up to a size of 37 in. long by 18 in. wide by $16\frac{1}{2}$ in. high (all measurements external), while the wall thickness may be from $\frac{1}{4}$ to $\frac{1}{2}$ in.

A CHEMIST'S BOOKSHELF

THE B.D.H. BOOK OF ORGANIC REAGENTS. 8th (Enlarged) Edition. London: British Drug Houses, Ltd. Pp. 155. 3s. 6d.

Since the issue of the 7th edition of this book in January, 1939, under the title "B.D.H. Reagents for Delicate Analysis," considerable advance has been made in the application of organic reagents to analytical procedure. The present revised edition contains 35 pages more than its predecessor, while references to current literature have been supplemented by over 150 new entries. Noteworthy additions include the employment of *p*-amino-acetophenone as a reagent for vitamin B_2 and of 2:4-dinitro-phenylhydrazine for the determination of vitamin C; also the monograph on tannic acid for the separation of titanium, zirconium, etc.

In addition to matter relating to spot-tests as applied to micro-analysis, the book includes adequate working details for many colorimetric determinations and larger-scale methods of analysis in which organic reagents are employed. All essential references to the original literature are appended to each monograph. The index has been remodelled for the greater convenience of the user.

Personal Notes

DR. R. J. W. LE FEVRE, D.Sc., F.I.C., Lecturer at University College, was appointed Reader in Chemistry in London University on June 20.

MR. JOHN ALEXANDER BIGGART, chemical manufacturer, Bridge of Weir, is a director of a new company of heating engineers, etc., just registered in Edinburgh under the title of Air Heating, Ltd.

MR. EDWARD WILLIAM PATES, as a result of the 1941 examination for associate-membership of the Institution of Chemical Engineers, has been awarded the William Macnab Medal for this year.

MR. R. L. KIRKCALDIE (Duncan Flockhart and Co.), chemical manufacturer, 104 Holyrood Road, Edinburgh, has been admitted to membership of Edinburgh Chamber of Commerce

MR. G. W. MITCHELL has been appointed by the Minister of Works and Buildings to be Controller of Building Materials, in succession to MR. HUGH BEAVER, now Director-General, Works and Buildings.

MR. ANDREW AIKMAN, sales manager of Messrs. John Mackay and Co., Ltd., manufacturing chemists, Edinburgh, has been admitted as a member of the Edinburgh Merchant Company. Mr. Aikman is well known in the Scottish chemical trade and has been with the firm for some years.

The George Medal has been awarded to MR. WILLIAM MASON, a process hand employed at Salford, for emptying an oil storage well into which a bomb had fallen. The pump-house was only 12 feet from the well containing 500 gallons of oil. An hour after he had completed the work the bomb exploded and wrecked the pump-house.

MR. W. A. SYCAMORE and MR. A. C. PARKER have been appointed sales manager and London manager and deputy boiler manager, respectively of Davey Paxman and Co. (Colchester), Ltd., engineers and boilermakers. This follows the death of Mr. M. R. F. H. Stuart, A.M.I.C.E., A.M.I.Mech.E., which was reported in our issue of May 24.

SIR WILLIAM FRASER, who was deputy-chairman, has been appointed by the Board as chairman of the Anglo-Iranian Oil Company in succession to the late Lord Cadman. Sir William Fraser, who was knighted in 1939, is a director of 22 other oil companies, including Shell Mex and B.P., Burmah Oil Co., Iraq Petroleum Co., Anglo-Egyptian Oilfields, Mosul Oilfields, Scottish Oils and Steaua Romana.

DR. THOMAS MIDGLEY, chairman of the board of directors of the American Chemical Society, and vice-president of the Ethyl Gasoline Corporation, has been awarded the Priestley Medal, the highest honour bestowed by the A.C.S. Dr, Midgley discovered the use of tetraethyl lead as an anti-knock agent, and has carried out important work on air-conditioning refrigerants.

MR. GEOFFREY E. HOWARD has been appointed chairman of Howard and Sons, Ltd., in succession to MR. ALFRED H. HOWARD, who has retired while remaining a member of the Board. Mr. Alfred H. Howard, a leading authority on quinine, is 79 and has been associated with the company for 60 years, having been chairman since 1916. MR. C. F. HOWARD has been appointed vice-chairman.

OBITUARY

SIR ROBERT WADDINGTON, who died on June 25 at Clifton Hall, near Preston, aged 71, had been Controller of Dyestuffs since 1939. He was formerly chairman of the Dyestuffs Advisory Licensing Committee, and sat as Conservative M.P. for Rossendale in 1923-29.

MR. J. W. WRIGHT, who died on June 15 in a Liverpool hospital, following an operation, was staff manager of Evans, Sons, Lescher and Webb, Ltd., manufacturing chemists. He was 55 years old and had been with the firm for about 40 years. He had been mainly engaged in the transport side of the company's interest.

DR. JOHN A. SCHAEFFER, Ph.D., who recently died aged 54, was president of Franklin and Marshall College, Lancaster, Pennsylvania, where he graduated in 1904. He received his Ph.D. degree from the University of Pennsylvania, afterwards teaching chemistry at the Carnegie Institute of Technology. He was a notable member of the world of American chemistry.

MR. P. C. HOLMES HUNT, F.I.C., M.Inst.C.E., who died suddenly last month at Sydney, was a member of the Chemical Engineering Group of the Society of Chemical Industry. He had been Director of Substitute Fuels to the Commonwealth Government, and only a month before his death, as we recently announced, he had been appointed to represent public interests on the Board of National Oil Pty., Ltd.

PROFESSOR N. S. KURNAKOV, who died recently at the age of 80, was director of the Institute of General and Inorganic Chemistry of the Academy of Sciences of the U.S.S.R. He one of the most distinguished of Soviet scientists and only a few days before his death had been awarded a Stalin prize for his work in physical chemistry. In Russia he was perhaps best known for his monumental work "An Introduction to Physico-Chemical Analysis," an indispensable reference book to Soviet chemists. In the outside world his scientific reputation rests largely on the recording pyrometer of his design, an instrument that automatically records changes in the properties of metals with a change in their composition.

PROFESSOR ROBERT ROBISON, F.R.S., D.Sc., Ph.D., F.I.C., the eminent biochemist, died on June 18 at his home in Putney, London, S.W.15, aged 57. Dr. Robison occupied the Chair of Biochemistry at London University, and had been head of the biochemical department of the Lister Institute of Preventive Medicine since 1931. He was a native of Newark-on-Trent, and was educated at University College, Nottingham, and at Leipzig University, where he took the Ph.D. degree. He had been lecturer in chemistry at the University Colleges of Galway and Nottingham before the last war, and served in the R.A.M.C. in 1915-19. In 1930 he was elected to Fellowship of the Royal Society and in 1931 was Herter Lecturer at New York University.

British Chemical Prices

Market Reports

BUSINESS in general chemicals continues to pursue an active course, and on the whole the market shows little change from the conditions reported last week. A moderate scale of new business has been put through and a fair export inquiry has been maintained. The price position throughout the market is steady, quotations in many instances showing firmer tendency. Buying interest in the coal tar products market remains active and quotations generally display a firm undertone. Crude carbolic acid, cresylic acid, creosote oil and the xylols are all quoted at strong rates; pitch, however, continues dull.

MANCHESTER.—A strong tendency is still to be noted in most of the Manchester chemical market, though movements since last report have not been of much consequence, On the whole, sellers have little of which to complain regarding the rate at which contract specifications are coming through, whilst actual new business during the past few days has been on a fair scale, including some export bookings. A rising tendency is still in evidence in the market for tar products, the majority of which are finding ready outlets.

GLASGOW.—There is no change in the Scottish heavy chemical trade since last week. Steady day to day transactions still continue, but export inquiries remain rather quiet. Prices remain firm.

Price Changes

Antimony Sulphide.—Golden, 11½d. to 2s. per lb.; Crimson, 1s. 10d. per lb.

Arsenic Sulphide.—Yellow, 1s. 10½d. to 2s. 2d. per lb.

Cadmium Sulphide.—5s. 8½d. to 6s. 6d. per lb.

Carbolic Acid.—MANCHESTER: Crystals, 10½d. per lb., d/d; Crude, 3s. 10d. to 4s., naked at works.

Carbon Black.—5¼d. to 8½d. per lb., according to packing.

India Rubber Substitutes.—White, 5 5/16d. to 9d. per lb.; dark, 5 9/16d. to 8½d. per lb.

Naphtha.—Solvent, 90/160°, 2s. 4d. to 2s. 7d. per gal.; Heavy, 90/190°, 1s. 10d., naked at works. MANCHESTER: 90/160°, 2s. 4d. to 2s. 8d.

Chemical Arbitration Award

Increase of Wages Disallowed

THE award of the National Arbitration Tribunal, consequent upon the dispute between Messrs. William Blythe & Co., Ltd., Church, Lancs., and certain of their employees, has now been promulgated. The dispute had been reported to the Minister of Labour and National Service by the Chemical Workers' Union, on behalf of the employees, and was referred by him to the tribunal on May 14.

The dispute arose out of a claim by the Union for an increase of 2d. an hour for burnermen and salt-cake workers, double time for Sundays and statutory holidays, and the reinstatement in employment of two local Union officials.

At the sitting of the tribunal held in London on June 10 statements and documents were submitted, dealing with the nature of the company's trade, and of the work of the employees affected, and also with the rates of wages for these employees and for overtime paid by the company. The rates in question were, in both cases, those provided by the Schedule of Wage Rates and Working Conditions in the heavy chemical and allied industries, fixed by the Chemical Trade Joint Industrial Council, of which the Chemical Workers' Union are not members. An investigation was also made into the circumstances in which the services of the two workers whose reinstatement was asked for were terminated by the company.

The tribunal gave careful consideration to the statements and submissions of the parties concerned; they found against the claim for increases in wages rates and overtime rates, and awarded accordingly. The claim for reinstatement was withdrawn by the Chemical Workers' Union in the course of the hearing.

The tribunal in the present case was composed of the Hon. Mr. Justice Simonds (chairman), Sir John Forster and Sir W. David Ross (appointed members); and Mr. H. F. Brand and Mr. W. Stott (panel members).

New Tanker Construction

Greater Resistance to Corrosion

THE International Nickel Co. of New York has developed a new method of constructing tankers which is said to lengthen their span of life. Hitherto the cargo of petrol or petroleum has come into direct contact with the steel bulkheads and outer plates of the hull. The corrosion at times is so powerful that holes are eaten through the metal plates, thus causing the cargo to escape. Attempts have been made to overcome this corrosion by galvanising the steel plaes or by using special alloys. This has not been effective. In the new construction the tanker is built of composite plates of ordinary steel joined together at their contacting edges and bonded together at their contacting surfaces. The top plate exposed to the oil is of less expensive steel than the under plate to which it is attached. Alone, the contacting plate resists corrosion to a lesser degree than the other plate, but the two together set up an electrical potential which is claimed to be corrosion-resisting. In addition structural strength is added to the ship without greatly increasing its weight.

Plasticisers for Wood

Effect of Urea Impregnation

FURTHER experiments in the addition of plasticisers to wood (*cf.* THE CHEMICAL AGE, February 22, p. 106) have been carried out at the Forest Products Laboratory, Madison, Wisconsin. It has been shown that oak, impregnated with a concentrated solution of urea and then dried, becomes plastic and can easily be bent, twisted, or compressed at a temperature of about 100° C., owing to the softening of the lignin. As soon as the wood resumes a normal temperature it hardens. Further, the sawdust and chips of wood thus treated, when raised to a high temperature, have been found to possess thermoplastic qualities.

Chemical Matters in Parliament

Iron Ore, Northern Ireland

IN the House of Commons last week, Dr. Little asked the Minister of Supply whether he had had the promised further samples of iron ore taken from the mine in County Down; whether these samples had been tested; and with what result. Mr. Harold Macmillan replied that he was not yet in a position to add to his answer of May 8. Recent reports from Northern Ireland stated that conditions were still unsuitable for sampling. The Ministry of Commerce in Northern Ireland would advise them of the right moment at which to take these samples.

Dental Cement

Mr. Jackson asked the Minister of Health whether he would arrange for a thorough trial to be made of the quality of British-made dental cement, and, if the results proved satisfactory, would see that this cement is used by dentists under his control, thus saving our currency. Mr. E. Brown explained that the import of dental cement had for some time past, been limited to small quantities of a special cement required for fixing appliances in cases of jaw injury, for which there was at present no completely satisfactory British substitute. Tests had already been made of a number of suggested substitutes for this special cement, and he would be glad to have a thorough test made of any others which might be submitted for trial.

Manufacturers' Claim

Damages Against Man who Left Work

AT Bow County Court, on June 23, Judge Jardine awarded £5 damages to Messrs. Hemingway & Co., Ltd., chemical manufacturers, Stratford, E., against William Robert Cox, of Belton Road, Leytonstone, who was formerly in their employ as a stoker. Plaintiffs claimed £15 damages on the ground that defendant wilfully absented himself from duty without notice and without reasonable cause, thereby causing them to suffer loss of profit on a load of chemicals which would have been dried had defendant remained at work.

Mr. G. J. Jones, managing director and secretary to Messrs. Hemingway, stated that defendant was in charge of the boiler house, and as a consequence of his leaving the premises at 9.30 p.m. on May 19, without permission, no work whatever was done that night, there being no steam. When defendant returned to work two days later, witness refused to let him start and paid him up to the time he had worked on the day he left.

Defendant stated that when he left he was under the impression that the boiler had been taken over by another man. Judgment was entered as stated, the Judge dismissing a counter-claim by defendant for £4 12s. 6d., a week's wages in lieu of notice to leave.

Smudgeless Printing Ink

Method Discovered in Venezuela

A SMUDGELESS printing ink has been produced by chemists operating in Venezuela. The base of the ink is a plastic called Aruba Bitumen; it is being produced by the Standard Oil Co., presumably from the crude oil in their wells on Aruba, the Dutch West Indian island off the Venezuelan coast. The smudgeless quality is due to the cooling process adopted which is the same as that employed in the cooling of thermoplastics. When the ink is spread sufficiently thin for printing the drop in temperature causes it to form a hard surface. No special temperature is needed, however, in the printing shop. The ink is manufactured from a certain group of hydrocarbons. By heating and chilling, the plastic is changed from a heavy liquid to crystals resembling slack coal. They are then converted into ink by the usual methods.

General News

FOXGLOVES, FERNS, VALERIAN, sphagnum moss, couch grass, coltsfoot and wood sage are among the medicinal plants listed for collection by school children in the North-East Scotland area.

THE ADDRESS OF Robert Airey and Son, specialists in the manufacture of vats and tanks, is 264 Manchester Road, Huddersfield (Tel.: Huddersfield 976).

A DEMONSTRATION OF SILAGE, the largest ever held in this country, was arranged at Luton on Thursday last week by Luton Corporation and Imperial Chemical Industries, Ltd. Over 1000 local farmers were present.

X-RAY CAMERAS and cameras of special design, suitable only for industrial, scientific, or military use, are not chargeable with Purchase Tax, under a decision of the Customs and Excise Office, dated June 21.

MESSRS. BARIMAR, LTD., announce that they are now installed at their new address, Kent House, 22/24 Peterborough Road London, S.W.6 (Tel.: RENown 2147), where they are ready, as always, to execute urgent welding repairs.

VISITORS TO THE HERTFORDSHIRE AGRICULTURAL INSTITUTE at Oaklands, St. Albans, last Monday, were shown how straw, when treated with caustic soda, turns into a starchy food which is able to replace sugar-beet, pulp, and roots. By the installation of a simple plant at an outlay of something like £40 farmers can help solve the problem of the shortage of livestock fodder.

A RESEARCH SCHOLARSHIP of the value of £250 a year and tenable for two years has been founded by the Wrought Light Alloys Development Association to encourage and facilitate research in the application of light alloys to ship construction. Particulars of entry, which closes on July 31, can be obtained from the Secretary Institution of Naval Architects, 10 Upper Belgrave Street, London, S.W.1.

THE INSTITUTION OF CHEMICAL ENGINEERS announces that the following candidates were successful in the associate-membership examination for 1941: Ronald George Francis Fowler; Hugh Neil Cameron MacLennan; Leonard Pearce Mould; John Kenneth Musson; Edward William Pates; Richard Henry Roberts; Charles Albert Rock; Gerald Stott Tarboton; John Francis Thomson. Of these candidates Messrs. MacLennan and Tarboton took the examination in South Africa.

BRITISH STANDARD SPECIFICATIONS (Nos. 960-965), for leaded bronze castings and ingots, have been based on proposals prepared by the Institute of British Foundrymen. The specifications follow the lines of similar standards for gun-metal castings. They provide for three alloys, designated as follows: 85/10/0/5 leaded bronze; 80/10/0/10 leaded bronze; and 76/9/0/15 leaded bronze. For each alloy separate specifications are given for ingots and castings. The numbers usefully represent the percentages of copper, tin, zinc, and lead respectively. The absence of zinc is indicated so as to differentiate these alloys from the gun-metal alloys covered by B.S. 898-901. Copies of these six specifications (bound in one cover) may be obtained from the British Standards Institution, price 2s. (post free 2s. 3d.).

Foreign News

CANADIAN CHEMICAL EXPORTS for April reached a total value of $3 million compared with approximately $2¾ million for the same month last year.

UNITED STATES EXPORTS of coal-tar colours, dyes, stains, etc., to Canada during 1940 amounted to 4,659,911 lb. valued at $3,118,458, according to preliminary data, compared with 3,889,617 lb. at $2,177,702 in 1939.

A NEW GERMAN TRADE DRIVE was launched in Turkey on June 20 with the object of attempting to secure chromium and copper ores, which British buyers have under option but are unable to take out of the country because of the scarcity of transport.

THE B. F. GOODRICH CO., OF AMERICA, have produced a new paint called "Koroplate," the base of which is polyvinyl chloride. It has been developed to protect metal surfaces against chemical reactions and only concentrated formic and acetic acids will attack it. One further advantage of the new paint is that it can be applied with either a brush or spray at the same temperature.

From Week to Week

AMMONIUM SULPHATE IMPORTS into the United States totalled 42,234 long tons at $1,274,541 in 1940, compared with 110,761 tons in 1939 and an average of 118,000 tons in the three previous years. Most of the 1940 imports originated in Canada.

THE GIFTER CORUNDUM COMPANY of South Africa has taken over the corundum deposits recently discovered at Marandellas and Rusaph in Southern Rhodesia. It is anticipated that production on an increased scale will be carried on.

THE EIRE IMPORT DUTY on matches has been raised. The new preferential rate for wooden matches in boxes containing between 20 and 50 is 8s. 5d. per gross container, as against the former price of 4s. 9d.

DRASTIC RESTRICTIONS ON CIVILIAN USE of petrol have been imposed in Rumania, according to an Associated Press report. A shortage of fats, oil, coffee, flour, soap, textiles, and leather is reported in Bucarest.

THE FOLLOWING CHEMICALS, used as stains in the form of solutions, or in solid form in containers of not more than 1 oz. net weight, are now admitted into New Zealand free of customs duty: diaminotoluene and its dihydrochloride; dibromoquinone chloroimide; and methyl thionine thiocyanate.

THE CONSTRUCTION, AT CORNWALL, ONTARIO, of a $300,000 plant, the first to manufacture carbon bisulphide in Canada, was scheduled to start on June 9. The plant will be built by Cornwall Chemicals, Ltd., an associate company of Canadian Industries, Ltd., and is expected to begin operations early in the new year.

GERMAN CHEMISTS are said to be investigating an "ersatz" varnish on account of the scarcity of linseed oil. Rumours reaching the United States say that the new product consists of a thick greasy substance and a volatile solvent in equal proportions. Needless to say, consumers in Germany will be compelled to use the substitute material.

THE PRODUCTION OF SULPHITE ALCOHOL in Sweden should have risen by 10 to 15 per cent. since the new alcohol factories at Ortviken, Hoernefors and Bengtsfors were scheduled to start activity in May or June. The annual capacity of the factories will be respectively 2,500,000, 2,700,000, and 1,100,000 litres of 95 per cent. alcohol. Moreover, the building programme for the alcohol factories comprises the construction of another factory at Robertsfors with an annual production of 1,500,000 litres.

A NEW METHOD OF MILDEW- AND MOTH-PROOFING rubber-coated fabrics such as raincoat material has been developed by the United States Department of Agriculture (U.S.P. No. 2,238,850) First the fabric is treated with soapy water then with cadmium fluosilicate, whereupon a reaction takes place which causes a cadmium soap to precipitate within the fibre of the fabric. The cadmium soap, of which 0.05 per cent. only is necessary, is said to be twice as effective as copper salts, hitherto used for protection against mildew, while fluosilicate discourages the moths.

Forthcoming Events

A JOINT MEETING of the Manchester Sections of the Society of Chemical Industry and of the Institution of the Rubber Industry will be held at the Engineers' Club, 17 Albert Square, Manchester, on June 30 at 7 p.m., when a lecture entitled "Polythene: Its Properties and Uses" will be delivered by Mr. E. G. Williams, B.Sc.

THE 60TH ANNUAL GENERAL MEETING of the Society of Chemical Industry will be held in the Lecture Hall of the Royal Institution, Albemarle Street, London, W., on July 8, at 2.30 p.m., and if it be necessary to adjourn, it will be continued in the Lecture Room of the Chemical Society at Burlington House, London, at 4 p.m., on August 8. The usual business meeting will be followed by the President's Address, and by tea at the invitation of the president. At about 4.30 to 4.45 p.m. the Society's medal will be presented to Sir Robert Pickard, who will then deliver his address. Before the meeting an informal lunch will be taken at Stewart's Restaurant, 50 Old Bond Street. Attendance is limited to 80, including ladies. Accommodation will be booked in rotation and it will not be possible to seat anyone who has not notified the General Secretary before July 6—address, Clifton House, Euston Road, London, N.W.1.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

R. J. HAMER & SONS, LTD., Mitcham, paint manufacturers. (M., 28/6/41). May 29, debenture to Lloyd's Bank, Ltd., securing all moneys secured by a charge dated July 22, 1939; general charge. *£3060. October 21, 1940.

WALTON CHEMICAL CO., LTD., Liverpool. (M., 28/6/41). May 19, debenture to Martins Bank, Ltd., securing all moneys due or to become due to the Bank; general charge. *——. October 30, 1940.

SILICA GEL, LTD., London, W.C. (M., 28/6/41). June 7, assignment to Midland Bank, Ltd., securing all moneys due or to become due to the Bank; charged on contract moneys. *£600 (bankers). May 15, 1941.

Satisfaction

WOODLANDS CHEMISTS, LTD., London, E.C. (S., 28/6/41). Satisfaction June 7, of a charge registered. May 11, 1938.

County Court Judgment

LANDORE CHEMICAL CO., LTD., R/O, Millbrook, Landore, fertiliser manufacturers. (C.C.J., 28/6/41). £19 19s. 5d. April 23.

Company News

Cerebos, Ltd., announce an ordinary dividend of 30 per cent., less tax, making 40 per cent. for the year (same).

Anglo Chemical & Ore Co., Ltd., have increased their nominal capital beyond the registered capital of £1000, by the addition of £4000 in £1 shares.

The Bleachers' Association reports a net profit for the year to March 31 of £94,678. Payment of six months' arrears on 5½ per cent. cumulative preference stock to September, 1934, is also announced.

Reckitt & Sons, Ltd. (the company which owns approximately 65 per cent. of the capital of Reckitt & Colman, Ltd.), announce a net profit of £544,045 (last year, £608,291). Three interim dividends, totalling 15 per cent. have been paid, and the directors recommend a final dividend on the ordinary shares of 6½ per cent., plus a bonus of 3d. per share, making a total distribution for the year of 22½ per cent., the same as in 1939.

The directors of **British Alkaloids, Ltd.** (manufacturers of T.C.P.), have decided to recommend the following final dividends in respect of the year ended March 31: 8.09 per cent., less tax, on the 8 per cent. participating preference shares, making, with the interim dividend of 8 per cent., less tax, a total of 16.09 per cent., less tax, for the year, and 12 per cent., less tax, on the ordinary shares, making, with the interim dividend of 12 per cent., less tax, a total of 24 per cent., less tax, for the year.

Chemical and Allied Stocks and Shares

ALTHOUGH the general tendency in the stock and share markets has been less buoyant this week owing to the absence of improvement in the volume of busines, security values were fairly well maintained on balance. There was again very little selling, and other indications suggested general willingness to be prepared to take more than a short view, although the disposition has been to await developments in the hostilities between Germany and Russia. The tendency among industrial shares has been to favour those of companies engaged in work esenstial to the war effort, more particularly, of course, where the E.P.T. standard does not bear with exceptional severity. There are numerous companies connected with the chemical and allied industries which are included in this category, and, which according to current market views, have reasonable possibilities of being able to maintain dividends. Among these is Imperial Chemical, and the ordinary units are 31s. 4½d., compared with 31s. a week ago; the 7 per cent. preference units have, however, moved back slightly from 34s. to 33s. 7½d. On the basis of last year's 8 per cent. dividend, I.C.I. ordinary yield over 5 per cent., which compares favourably with the yields on many other leading industrial securities. British Oxygen have again been favoured, and have held their recent improvement to 66s. 3d., while at 42s. 6d. British Aluminium were slightly above the price ruling a week ago. Moreover, Borax Consolidated remained a firm feature at 28s. 3d. In other directions, Lever & Unilever were better at 22s., but a reaction from 41s. 3d. to 40s. 9d. was shown in British Oil & Cake Mills preferred ordinary units. B. Laporte ordinary remained firm at 60s., while Greeff-Chemicals Holdings 5s. ordinary were again around par, and Monsanto Chemicals 5½ per cent. preference continued to be quoted at 22s. 6d.

There was again a fair amount of activity in British Plaster Board 5s. ordinary pending the dividend announcement, and the price was higher at 15s. 6d. Associated Cement were steady at 53s. 9d. Wider recognition of the apparently generous yields was reflected by continuance of demand for iron, steel and kindred shares; Dorman Long were better at 19s., as were Stewarts & Lloyds at close on 44s. Moreover, United Steel were 24s. 1½d., and Tube Investments 92s. 9d. Awaiting the dividend announcement, Guest Keen were 23s. 9d. Following the maintenance of the year's distribution at 40 per cent., Cerebos were quoted at £7⅞. Among textile issues, Courtaulds showed small fluctuations, the disposition being to await the interim dividend declaration, due next month. Bleachers preference were steady on the payment on acount of dividend arrears. Pending the interim payment, Nairn & Greenwich were unchanged at 53s. 9d.; and Barry & Staines were slightly higher at 27s.; while Wall Paper Manufacturers deferred units were again 22s. At 20s. 6d. Pinchin Johnson were unchanged on balance, and business up to 85s. was shown in International Paint shares.

Boots Drug were steadier at 33s. 6d., but remained under the influence of the lower distribution and were less active, although the disposition is to await the full results and chairman's annual statement. Better demand was in evidence for General Refractories on the market view that the company's earnings may be running at an improved level. Pending the results for the past year's working, British Glues 4s. shares changed hands around 5s. 4½d. Murex have been a steady feature at 83s. 9d., but following their recent further rise, the units of the Distillers Co. have reacted from 66s. 6d. to 65s. 9d., the tendency being to await the dividend announcement. British Industrial Plastics were again rather more active and have transferred up to 2s. 7½d., while Erinoid showed business at 3s. 6d. at one time. There was a better tendency in Anglo-Iranian, " Shell " and other leading oil shares.

New Control Orders

Export of Lactic Acid, Bentonite, etc.

UNDER a Board of Trade Order of June 24, which comes into force on July 10, licences will be required to export to all destinations lactic acid and its salts and esters, and lactide. The Order (S.R. & O. 1941, No. 883) also extends the existing export prohibitions in respect of shellac, seedlac, sticklac and other varieties of these lacs; bentonite; and casein.

THE BRITISH DRUG HOUSES, LTD., Graham Street, N.1., have published a pamphlet describing the B.D.H. Spot-Test Outfit. This consists of 27 reagents and the appropriate apparatus for their use. By applying spot-tests to microchemical analysis it is sometimes possible to establish the presence of a metal without conducting a preliminary separation. It is hoped that the outfit will prove of great use to schools and colleges which are studying this branch of analytical chemistry. A copy of the B.D.H. Book of Organic Reagents for Analytical Use is provided with each set of reagents.

THE CHEMICAL DIVISION and 30 other divisions of the U.S. Bureau of Foreign and Domestic Commerce have been abolished in a general reorganisation of the bureau. There are now five major divisions: Research and Statistics, Industrial Economy, Regional Economy, International Economy, and Commercial and Economic Information. Mr. Charles C. Concannon, who was chief of the Chemical Division, has become an industrial consultant of the bureau.

AN INTERESTING ACCOUNT of the preparation of the "mysterious" poison curare by the Nyambikwara tribe of Amazonian Indians is contained in the March issue of the *Revista Farmaceutica*, Buenos Aires. The author, Mr. J. Vellard, on a mission into the Matto Grosso, actually watched the preparation of the poison for hunting-arrows, and proved that it is entirely of vegetable origin, being prepared by rough distillation, and concentration from the roots of a species of *Strychnos*. He points out, however, that the method and ingredients vary from tribe to tribe, though a strychnine preparation is always the basic component.

BRITISH ASSOCIATION OF CHEMISTS

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